Name: Sahib Bajwa

ID: 107553096

CSCI 3104, Algorithms **Profs. Chen & Grochow**

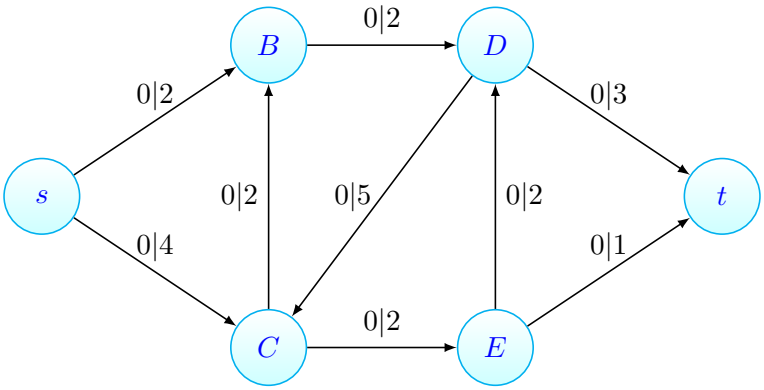
Exam 2 – S16 **Spring 2020, CU-Boulder**

Instructions: This quiz is open book and open note. You **may** post clarification questions to Piazza, with the understanding that you may not receive an answer in time and posting does count towards your time limit (30 min for 1x, 37.5 min for 1.5x, 45 min for 2x). Questions posted to Piazza **must be posted as PRIVATE QUESTIONS.** Other use of the internet, including searching for answers or posting to sites like Chegg, is strictly prohibited. Violations of these are grounds to receive a 0 on this quiz. Proofs should be written in **complete sentences. Show and justify all work to receive full credit.**

YOU MUST SIGN THE HONOR PLEDGE. Your quiz will otherwise not be graded. Honor Pledge: On my honor, I have not used any outside resources (other than my notes and book), nor have I given any help to anyone completing this assignment.

Your Name: Sahib Bajwa

Standard 16. Given the following network G with edge capacities and an initial flow of 0 ($f|c$ on an edge denotes that there is currently flow of f on the edge, and the edge has total capacity c). For the first iteration of the Ford-Fulkerson algorithm, we **select the path** $s \to C \to E \to D \to t$ **(Do not choose the first s-t path on your own—use this one!).**



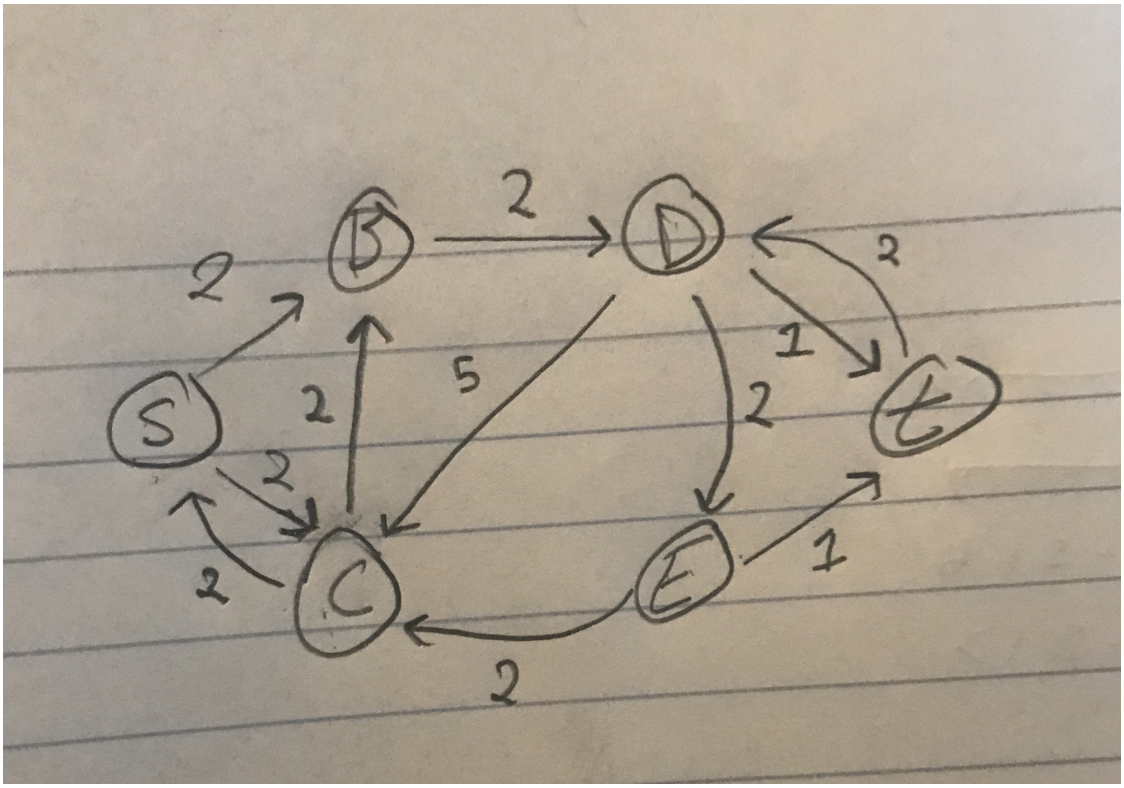
Name: Sahib Bajwa

ID: 107553096

CSCI 3104, Algorithms **Profs. Chen & Grochow**

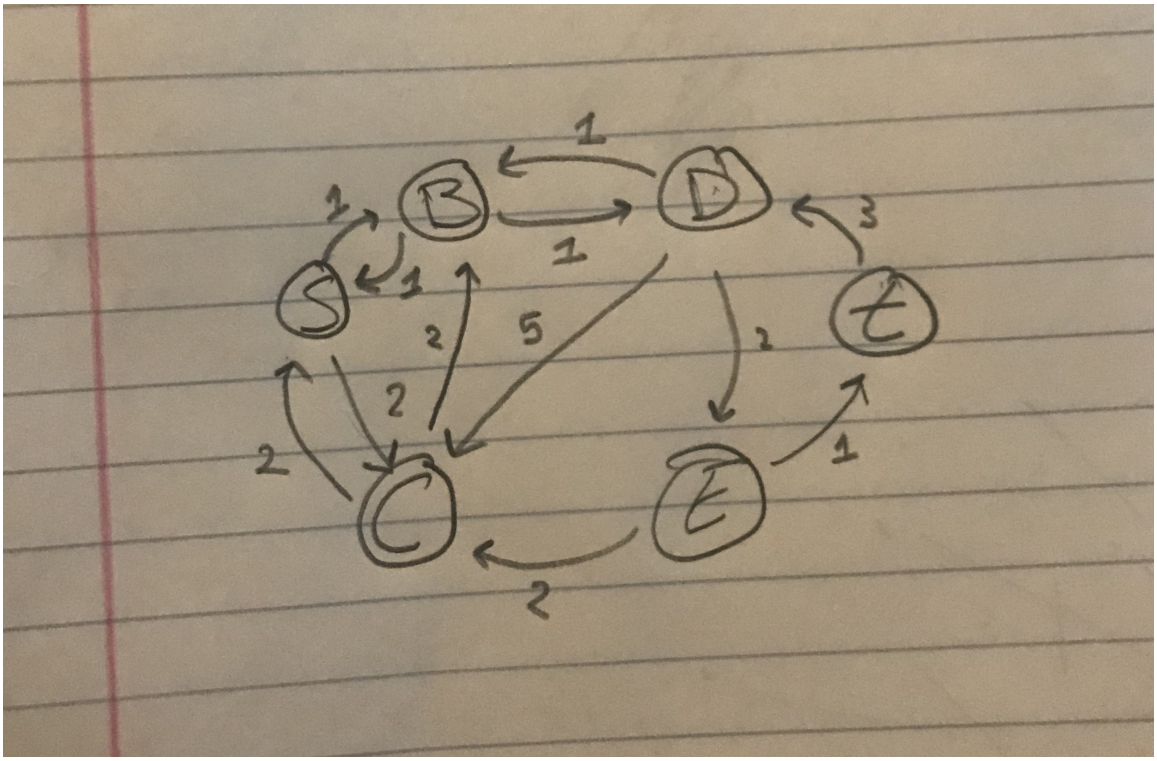
Exam 2 – S16 **Spring 2020, CU-Boulder**

(a) Draw the residual graph after we select the $s \to C \to E \to D \to t$ flow-augmenting path.



(b) Using $s \to B \to D \to t$ as the next flow-augmenting path, how much flow can you push along it? (Assuming you have already pushed flow along the $s \to C \to E \to D \to t$ path as in (a).) Draw the residual graph after flow has been pushed along this path and the previous one.

You can only push 1 flow along this path. This is due to there being only 1 flow possible through $D \to t$ because we have already pushed 2 flow through in the previous step.



(c) Starting using the two paths from (a) and (b), now complete the Ford–Fulkerson Algorithm. Your answer should consist of the following:

- The flow-augmenting paths you selected (*after* those from (a) and (b)) and the amount of flow you pushed through each path.
- The maximum $s \to t$ flow.
- The corresponding minimum cut, as well as the capacity of the cut.

You do not need to draw the updated flow networks or residual graphs, though you are welcome to do so if you wish.

There are no more flow-argument paths after (a) and (b). This is becasue the only way for us to push more flow from $s \to t$ is by putting 1 flow from $E \to t$. Since there is no way for us to push any more flow to E, there is no way for us to push any more flow to t as a result. The maximum $s \to t$ flow is therefor 3.
The corresponding minimum cut is (D, t) with a capacity of 3.